Indonesian Journal of Pharmaceutics
IdJP
ISSN : 2597-8748

Vol 3, Issue 2, 2021 (74-81)
http://journal.unpad.ac.id/idjp

Review: Bioactivities of Saffron as an Active Ingredient in Cosmetics

Irna Roniawati[1], Norisca Aliza Putriana[2], Adinda Naswa Putri[1], Yuniar Alfain Nur'aini[1]

[1]Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia
[2]Department of Pharmaceutics and Pharmaceutical Technology, Faculty of Pharmacy, Padjadjaran University, Sumedang, Indonesia

Submitted : 29 July 2021, Revised : 11 August 2021, Accepted : 21 Sept 2021, Published : 3 Nov 2021

Abstract

Saffron (Crocus sativus) is a plant that has been widely used in Asia, especially in the health sector. This can be related to other than that saffron is also known for its use as a cosmetic because Saffron has various kinds of pharmacological activities beneficial to human skin. Today's cosmetic users prefer cosmetics with herbal or natural ingredients, especially in Indonesia. This happens because it is considered that herbal cosmetics are safer and harmless in long-term use. Therefore, it is necessary to do related activity of saffron as a cosmetic ingredient. The aim of this review to provide information regarding the active substances in saffron that can be used as cosmetics. This is narrative research where the data is obtained from PubMed, Science Direct, and Google Scholar with keywords Saffron, Saffron for cosmetics, and others. There were eight references, with inclusion criteria being national and international journals and national websites published in 2011-2021, especially regarding the study of saffron activity as an ingredient for cosmetics. It was found that Saffron (Crocus sativus) contains compounds that have a cosmetic activity such as safranal which can be used as a perfume, crocin as an antioxidant and as anti-dark spot, crocin, safranal, and crocetin as anti-UV, crocin, and crocetin as an anti-inflammatory and as coloring pigment in cosmetics, vitamin C, flavonoids and zinc as a face toner, kaempferol, crocin and crocetin as anti-wrinkle, zeaxanthin, lycopene, carotene, crocetin, picrocrocin, kaempferol, and crocin as anti-aging. Saffron (Crocus sativus) has various beneficial activities for the skin, so it can be used as an ingredient in making cosmetics.

Keywords: Cosmetics, Herbal, Saffron, Herbal Cosmetics, Active Ingredient

1. Introduction

In Indonesia, cosmetics is one of primary needs for women. Even now it has been produced for men and children. (1). It makes the cosmetic industry has a very rapid economic growth from year to year. According to data from the Ministry of Industry of the Republic of Indonesia, the national cosmetic industry experienced an increase in the economic growth of 20% compared to economic growth in 2017.

The high demand for cosmetics has made many irresponsible people using harmful elements in the manufacture of cosmetics, such as lead (Pb), arsenic (As), and mercury (Hg) (2). Lead (Pb) in cosmetics will be absorbed in the body, causing organ damage and cancer. Meanwhile, arsenic in cosmetics can cause skin lesions, respiratory problems, and cancer (3). The active ingredient that used in cosmetics should be safe, effective, and the dose should be avoided from long-term effects and side effects such as dermatitis and allergies (4;5).

Increased production and distribution of harmful cosmetics, causing cosmetic users to become worried and afraid in using cosmetics. So that users start switching to herbal or natural cosmetics because they are considered safer

*Corresponding author,
e-mail : norisca@unpad.ac.id (N. A. Putriana)

https://doi.org/10.24198/idjp.v3i2.34876

(6). These herbal ingredients are obtained from plant parts of leaves, seeds, fruit, roots, stems, flowers, rhizomes, and other plant parts (7). Both are used in the whole form or have been made into powdered extracts (8).

There are various kinds of herbal cosmetic products such as herbal soap, herbal shampoo, herbal face wash, and others (7). In addition, some products function to protect the skin from the harmful effects of free radicals, maintain the keratin structure in good condition, and make the skin healthier and cleaner (6). This proves that herbal cosmetics have properties comparable to synthetic materials but are safer, lighter, and healthier to use. Therefore, herbal cosmetics are increasingly popular and favored by users (9),(10). One of the herbal cosmetics that is widely used by users in Indonesia is cosmetics made from Saffron (*Crocus sativus*) (11). Saffron in the market is sold in the form of a cream joint which is efficacious as an anti-wrinkle and also in the form of a face toner (12).

Saffron (Crocus sativus) is a plant originating from the genus Iridaceous (13), which has been widely used in Asia, especially in the health sector, which can be related to its use as a cosmetic because Saffron has a wide range of pharmacological activities beneficial for human skin (14). Saffron contains many chemical compounds, including crocin, safranal, crocetin, picrocrocin (15). crocin compounds contain high glycosyl compounds so that they dissolve in water and give a red or orange color to Saffron, safranal compounds are volatile compounds that produce aroma, and picrocrocin compounds are compounds that give saffron taste and aroma (16;14). These compounds have effects such as antioxidant, anti-UV, anti-inflammatory, anti-aging, anti-wrinkle, anti-dark spot, face toner, and can produce color and aroma pigments (perfume) so that Saffron can be used as an astringent active in herbal cosmetics (11;17).

2. Method

The method used when writing this article is narrative research. The library sources used are as many as 49 libraries, both from books, official websites, national or international journals. The search for library sources was carried out through databases at PubMed, Science Direct, and Google Scholar with Saffron, Crocus sativus, Cosmetic, Saffron for cosmetics, Saffron Cosmetics, and so on. Next, selecting the library sources that will be used is carried out by reviewing the title and abstract. The libraries used include libraries published in the last ten years.

3. Result

There are 536 journals obtained from PubMed, Science Direct, and Google Scholar using keywords. Choose from every journal found through titles and abstracts taken with Saffron benefits for cosmetics. The results of the selection were obtained from 8 journals which are then analyzed narratively.

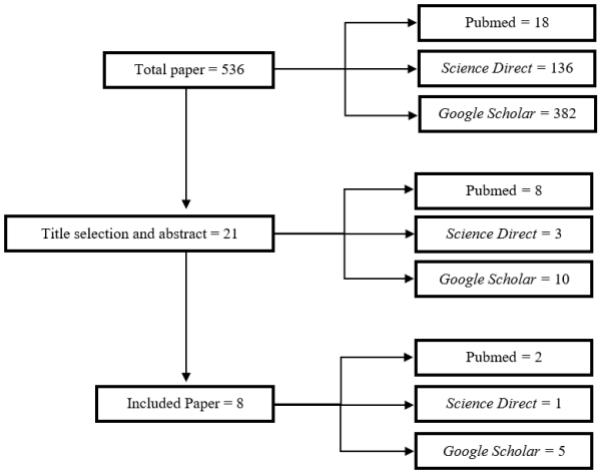

Figure 1. Paper selection algorithm

4. Discussion

a. Antioxidant

In Saffron, high antioxidant activity is provided by crocin as a carotenoid. Crocin showed high radical scavenging activity (50% and 65% for 500 and 1000 ppm solutions in methanol, respectively), followed by safranal (34% for solutions of 500 ppm). This compound's high radical scavenging activity may be due to its ability to donate hydrogen atoms to DPPH radicals (19).

b. Anti-Inflammation

Saffron activity is an anti-inflammatory derived from crocetin and crocins compounds (21). Both of these compounds have strong antioxidants shown through their inhibition in producing pro-inflammatory cytokines such as IL-1 production by suppressing NF-B activity through inhibition of phosphorylation I kappa B kinase-a (IKK-a) and prevention of nuclear translocation of NF-B. p65 subunit (22). Crocin at a dose of 20 mg/kg can inhibit several pro-inflammatory cytokines (IL-1β, IL-6, and TNF-α) and inflammatory mediators (prostaglandin E-2 (PGE-2) and COX-2) production (21). In addition, crocin and safranal also suppress the inflammatory pain response and reduce the number of neutrophils (28).

Table 1. Activity of saffron and its compounds.

Effect	Compound	Activity	Reference
Perfume	*Safranal*	Main components of saffron essential oil.	[18]
Antioxidant	*Crocin*	High radical scavenging activity	[19]
Anti-UV	*Crocin*, *Safranal*, and *Crocetin*	As an antioxidant that can counteract and damage UV radiation on the skin	[20]
Anti-Inflammation	*Crocin* and *crocetins*	Inhibits that some pro-inflammatory cytokines	[21] [22]
Face Toner	Vitamin C, Flavonoid and Zinc	Vit. C: treat hyperpigmentation Flavonoid: brighten the face Zinc: retinol protein binder	[23]
Anti-Wrinkle	*kaempferol*, *crocin* and *crocetin*	Antioxidant	[24]
Anti-Aging	*zeaxanthin*, *likopen*, *karoten*, *crocetin*, *picrocrocin*, *kaempferol*, and *crocin*	Antioxidant	[25] [26]
Anti-Dark Spot	*Crocin*	Inhibits the enzyme tyrosinase	[27]
Coloring Pigments in Cosmetics	*Crocin* and *crocetins*	It gives red or orange	[14]

c. Anti-UV

Saffron flowers (Crocus sativus) contain main compounds such as crocin, safranal, and crocetin which have various activities, for example, as antioxidants (20). Safranal is an aldehyde monoterpene that is included in the main volatile compounds in Saffron Flowers. Safranal can act as an anti-UV due to its activity as an antioxidant that can counteract free radicals from ultraviolet (UV) rays. This is because the impact of UV rays on the skin can cause dry skin, wrinkles, and even sagging (29).

Anti-UV, commonly called Sunscreen, is included in photoprotection, which can prevent and even damage UV radiation that harms the skin, such as aging (30). In addition, UV radiation can cause sunburn to skin cancer (31).

d. Face Toner

According to Salvi and Prima's 2021 study, the pistil of Saffron (Crocus sativus) can be used as a face toner because it contains Vitamin C, Flavonoids, and Zinc which can traditionally treat facial skin. Vitamin C contained in the pistil of the Saffron flower is 1.41%. Vitamin C serves to treat hyperpigmentation (32). Zinc functions as a component of the retinol-binding protein so that Vitamin A can flow in the blood. Flavonoids function to depigmentation or are often referred to as brightening agents to inhibit

tyrosinase activity when the melanogenesis process occurs (23).

Face toner can function as a cleanser after making facial repairs with facial cleansers to remove excess sebum on facial skin so that this face toner has anti-sebum activity (33, 34). In addition, facial toner is also useful for hydrating the skin to maintain its moisture (35).

e. Anti-wrinkle

Anti-wrinkle reduces or eliminates wrinkles due to age, stress, smoking, or exposure to free radicals or UV. So that in anti-wrinkle activity, compounds containing antioxidants are needed (36) (37) (38). In the research of Zeka and Mashmoul, it was found that the petals of Saffron (Crocus sativus L.) (24) (19) have antioxidant effects derived from kaempferol, crocin, and crocetin compounds, and there are safranal compounds that have antioxidant activity (39).

f. Anti-aging

Like anti-wrinkle, anti-aging can work well if it contains antioxidants (40). Saffron (Crocus sativus) contains zeaxanthin, lycopene, carotene, crocetin, picrocrocin, kaempferol, and crocin compounds that act as antioxidants (25, 26).

One of the factors that cause skin aging is exposure to UV radiation. So, the use of anti-aging is usually accompanied by anti-UV (41). Exposure to UV radiation, especially UV A light, can increase the number of reactive oxygen species and enzymes that act as protective antioxidants such as catalase. Catalase enzymes are commonly used as biomarkers or important indicators of oxidative stress. If in large quantities, it can cause damage to the skin, such as skin aging (42, 43).

g. Anti-dark spot

Saffron is known to reduce melamine in which dark spots are formed from the process of melanogenesis by the occurrence of an oxidative reaction that is controlled and accelerated by the tyrosinase enzyme, which will form melanin from a mixture of the pigments eumelanin (dark brown) and phaeomelanin (yellowish-red) which causes the formation of dark spots on the skin (44) (11). Increased melanin, especially the pigment eumelanin, can be caused by ultraviolet radiation (45). Saffron contains crocin compounds that can inhibit the activity of the tyrosinase enzyme by damaging the hydrogen bonds in the tyrosinase, which causes rearrangement and conformational changes in the enzyme and based on silicon docking studies, crocin forms extensive hydrophobic interactions with amino acid residues of the tyrosinase enzyme and crocin is an inhibitor. Mixed competitive type (27). So that Saffron can be used as an anti-dark spot and significant depigmentation in reducing skin melanin (11).

h. Perfume

In the era of Ancient Greece, Saffron was often used as a perfume by the royals because it had a sensual fragrance and was admired by the Greeks (11). Saffron has more than 150 volatile and aroma-producing compounds. Safranal is one of the main components of saffron essential oil. It is formed by hydrolysis of picrocrocin when it's drying and storage (18). Studies have shown that a higher temperature of around 80◦C and a less processing time of up to 30 minutes will result in a larger amount of safranal. Saffron, with good quality, has 2.5% volatile compounds such as safranal (46).

i. Coloring Pigments in Cosmetics

Saffron has been used as a natural color for the manufacture of cosmetics since ancient times. Reddish gold, orange, and orange-red colors are produced by Saffron (47;23). these colors have resulted from crocetin and crocin compounds of Saffron(48), which have the carotenoid glycoside structure (48).

5. Conclusion

Saffron has various activities, as an antioxidant, anti-UV, anti-inflammatory, perfume, face toner, anti-wrinkle, anti-aging, anti-dark spot, and can provide color pigments.

So that Saffron has the potential to be used in the manufacture of cosmetics.

Acknowledgement

The author would like to thank Apt. Norisca Aliza Putriana, M.Farm as a Advisor who has guided the author to carry out this review. And also Prof. apt. Rizky Abdullah, S.Si, Ph.D. as a lecturer in Metodologi Riset dan Biostatistik at the Faculty of Pharmacy, Padjadjaran University.

References

1. Kemenperin. Industri kosmetik nasional tumbuh 20%. 2020. (download on April 24, 2021). Available at: https://www.kemenperin.go.id/artikel/18957/Industri-Kosmetik-Nasional-Tumbuh-20.

2. Wang W, Ning B, Wenfeng Y, Nianpeng S, Hua B, Haiyu L, et al. Simultaneous determination of lead, arsenic, and mercury in cosmetics using a plastic based disposable electrochemical sensor. Microchemical Journal. 2019;148:240-7.

3. Bhowmick S, Sreemanta P, Payel S, Priyanka M, Debashis C, Jerome N. Arsenic in groundwater of West Bengal, India: A review of human health risks and assessment of possible intervention options. Science of The Total Environment. 2018;612:148–69.

4. Patisaul HB, Heather BA. Long-term effects of environmental endocrine disruptors on reproductive physiology and behaviour. Front Behav Neurosci. 2009;1-18.

5. Park JD, Wei Z. Human exposure and health effects of inorganic and elemental mercury. J Prev Med Public Health. 2012;45(6):344-52.

6. Joshi LS, Pawar H. Herbal cosmetics and cosmeceuticals: an overview. Natural Products Chemistry & Research. 2015;3(2):1-8.

7. Bijauliya RK, Shashi A, Mayank K, Dilip KC, Shrishti Y. A comprehensive review on herbal cosmetics. International Journal of Pharmaceutical Sciences and Research. 2017;8(12):4930-49.

8. SahuAlakh N, Jha S, Dubey SD. Formulation & evaluation of curcuminoid based herbal face cream. Indo-Global Journal of Pharmaceutical Sciences. 2011;1(1):77-8.

9. Kanlayavattanakul M, Nattaya L. Plants and natural products for the treatment of skin hyperpigmentation - a review. Planta Med. 2018;84(14):988-1006.

10. Taofiq O, Sandrina A, Heleno, Ricardo CC, Isabel PF, Maria JA, Lillian B, et al. Mushroom-based cosmeceutical ingredients: microencapsulation and in vitro release profile. Industrial Crops and Products. 2018;124:44-52.

11. Mzabri I, Mohamed A, Abdelbasset B. Traditional and modern uses of saffron (Crocus Sativus). Cosmetics. 2019;6(4):63.

12. Naeimifar A, Saman AN, Aniseh S, Roya T, Seyed SA, Amir MH, et al. Preparation and evaluation of anti-wrinkle cream containing. Journal of Cosmetic Dermatology. 2019;19(9):2366-73.

13. Ismail RAJF, Nurma RN. Potensi saffron sebagai antidiabates. Jurnal Penelitian Perawat Profesional. 2020;2(1):99-104.

14. Afifah MN, Aliya NH. Saffron (Crocus sativus L): Kandungan dan Aktivitas Farmakologinya. Majalah Farmasetika. 2020;5(3):116-23.

15. Bolhassani A. Chapter 10 - bioactive components of saffron and their pharmacological properties. Studies in Natural Products Chemistry. 2018;58:289-311.

16. Hübert T, Carlo T, Ulrich B. Electronic Noses and Tongues in Food Science. Spain: Academic Press; 2016.

17. Cardone L, Donato C, Michele P, Nunzia C, Vincenzo C. Saffron (crocus sativus l.), the king of spices: an overview. Scientia Horticulturae. 2020;272:109560.

18. Kosar M, Demirci B, Goger F, Kara I, Baser KHC. Volatile composition, antioxidant activity, and antioxidant components in saffron cultivated in Turkey. International Journal of Food Properties. 2017;20(S1):S746-54.

19. Mashmoul M, Azrina A, Huzwah K, Barakatun NMY, Sabariah MN. Saffron: a natural potent antioxidant as a promising anti-obesity drug. Antioxidants. 2013;2(4): 293-308.

20. Mirhadi E, Hooriyeh N, Bizhan MN. An updated review on therapeutic effects of nanoparticle-based formulations of saffron components (safranal, crocin, and crocetin). Journal of Pharmaceutical Investigation. 2019;50:47-58.

21. Zeinali M, Seyed AR, Hossein H. An overview on immunoregulatory and anti-inflammatory properties of chrysin and flavonoids substances. Biomed Pharmacother. 2017;92:998-1009.

22. Pradère JP, Céline H, Christiane K, Richcard AF, Tom L, Robert FS. Negative regulation of NF-kappaB p65 activity by serine 536 phosphorylation. Sci Signal. 2016;1-9.

.23. Salvi A, Prima M. Kelayakan Sediaan Penyegar (Face Toner) Putik Bunga Saffron (Crocus sativus) sebagai Kosmetik Tradisional Perawatan Kulit Wajah. Jurnal Tata Rias dan Kecantikan. 2021;3(1):1-8.

24. Zeka K, Ketan CR, Maria AC, Dimitrios S, Francesco V, Randolph RJA. Petals of Crocus sativus L. as a potential source of the antioxidants crocin and kaempferol. Fitoterapia. 2015;107:128-34.

25. Akhtar N, Haji MSK, Shoaib A, Imran SM, Najam S, Kamran B. Moisturizing effect of stable cream containing Crocus sativus extracts. Pakistan Journal of Pharmaceutical Sciences. 2014;27(6):1881-4.

26. Jadoon S. Karim S, Muhammad HHBA, Muhammad RA, Abida KK, Arif M, Chunye C, Ghulam M. Anti-Aging Potential of Phytoextract Loaded-Pharmaceutical Creams for Human Skin Cell Longetivity. Oxidative Medicine and Cellular Longevity. 2015;1-17.

27 Anantharaman A, Hridya H, Rajendra RP, Mohan S, Mohan G, Nallasamy P, Ramamoorthy S. Inhibitory Effect of Apocarotenoids on the Activity Tyrosinase : Multi-Spectroscopic and Docking Studies. J. Biosci Bioeng. 2016;121(1):13-20.

28. Rahmani AH, Amjad AK, Yousef HA. Saffron (Crocus sativus) and its Active Ingredients: Role in the Prevention and Treatment of Disease. Pharmacogn J. 2017;9(6):873-9.

29. Madan K, Sanju N. In-vitro evaluation of antioxidant, anti-elastase, anti-collagenase, anti-hyaluronidase activities of safranal and determination of its sun protection factor in skin photoaging. Bioorganic Chemistry. 2018;77: 159-67.

30. Gabros A, Trevor AN, Patrick MZ. Sunscreens And Photoprotection. StatPearls Publishing; 2020.

31. Palm MD, Marianne NO. Update on photoprotection. Indian J Dermatol. 2012;57(5): 335-42.

32. Telang PS. Vitamin C in dermatology. Indian Dermatol Online J. 2013;4(2): 143-6.

33. Pongsakornpaisan P, Nattaya L, Mayuree K. Anti-sebum efficacy of guava toner: A split-face, randomized, single-blind placebo-controlled stud. Journal of Cosmetic Dermatology. 2019;18(6):1737-41.

34. Timudom T, Chaiyavat C, Bhagavathi SS, Pratya T, Duangporn N. Anti-Sebum Efficacy of Phyllanthus emblica L. (Emblica) Toner on Facial Skin. Appl. Sci. 2020;10(22):8193.

35. Yuanxi L, Hua W, Xiiong L, Li L. Comparison of skin hydration in combination and single use of common moisturizers (cream, toner, and spray water). J Cosmet Sci. 2016;67(3):175-83.

36. Kerscher M, Buntrock H. Anti-aging creams. What really helps?. Hautarzt. 2011;62(8): 607-13.

37. Kim SR, Yu RJ, Hye JA, Dae HK, Eun JJ, Yeon JC, Kyoung MM, et al. Anti-Wrinkle and Anti-Inflammatory Effects of Active Garlic Components and the Inhibition of MMPs via NF-κB Signaling. PLOS ONE. 2013;8(9): 1-12.

38. Zahruddin A, Damayanti. Penuaan Kulit: Patofisiologi dan Manifestasi Klinis. Periodical of Dermatology and Venereology. 2018;30(3): 208-15.

39. Bernad DC, Estefania VC, Joaquin JP, Maria JF. Saffron bioactives crocin, crocetin and safranal: effect on oxidative stress and mechanisms of action. Crit Rev Food Sci Nutr. 2020;24:1-18.

40. Ganceviciene R, Aikaterini IL, Athanasios T, Evgenia M, Christos CZ. Skin anti-aging strategies. Dermato-Endocrinology. 2012;4(3): 308-19.

41. Shanbhag A, Akshatha N, Reema N, Usha YN. Anti-aging and Sunscreens: Paradigm Shift in Cosmetics. Adv Pharm Bull. 2019;9(3): 348-59.

42. Amaro-Ortiz A, Betty Y, John AD. Ultraviolet Radiation, Aging and the Skin: Prevention of Damage by Topical cAMP Manipulation. Molecules. 2014;19(5): 6202-19.

43. Dewi NK. Efek Paparan Logam Berat Terhadap Kadar Malondialdehida dan Aktivitas Katalase Ikan Mas dan Ikan Nila di Sungai Kaligarang. Indonesian Journal of Mathematics and Natural Sciences. 2018;41(2): 69-75.

44. Moshiri, M, Vahabzadeh M, Hosseinzadeh H. Clinical Applications of Saffron (Crocus Sativus) and its Constituents : A Review. Drug Res (Stuttg). 2015;287-95.

45 Pinon A, Youness L, Ludovic M, Jeanne CM, Bertrans L, Christiane D, et al. A novel form of meloname apoptosis resistance: Melanogenesis Up-Regulation in Apoptotic B16-F0 Cells Delays Ursolic Acid-Triggered Cell Death. Experimental Cell Res. 2011;317(12):1669-76.

46. Rezaee R, Hossein H. Safranal: from an aromatic natural product to a rewarding pharmacological agent. Iranian journal of basic medical sciences. 2013;16(1):12-26.

47. Galanakis, CM. Saffron. London: Academic Press; 2021.

48. Javadi B, Amirhossein S, Seyed AE. A Survey on Saffron in Major Islamic Traditional Medicine Books. J Basic Med Sci. 2013;16(1):1-11.

49. Khazdair MR, Mohammad HB, Mahmoud H, Ramin R, Aristidis MT. The effects of Crocus sativus (saffron) and its constituents on nervous system: A review. Avicenna J Phytomed. 2015;5(5): 376-91.